DOCUMENT RESUME

ED 388 078 FL 023 328

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TITLE German for Engineers and Scientists: Initiatives in International Education.
PUB DATE Apr 95
NOTE 8p.; Paper presented at the Annual Eastern Michigan University Conference on Languages and Communication for World Business and the Professions (13th, Ypsilanti, MI, April 6-8, 1995). For related documents, see FL 023 315-327.
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Business Communication; College Second Language Programs; *Cross Cultural Training; Cultural Awareness; *Engineering Education; *German; Graduate Study; Higher Education; Intercultural Communication; International Educational Exchange; *International Studies; Internship Programs; *Languages for Special Purposes; Program Descriptions; Reading Comprehension; Science Education; Second Languages; *Study Abroad; Technical Writing; Translation; Undergraduate Study; Vocabulary Development
IDENTIFIERS Michigan Technological University

ABSTRACT

The Michigan Technological University program in German area studies is described. The program is designed for science and engineering students at both undergraduate and graduate levels. Its components include: a 1-year scientific German sequence, stressing specialized vocabulary, reading skills, use of reference materials, translation into English, and the more difficult linguistic structures characterizing scientific and technical literature of those fields; active exchange programs with German universities; internships in German industry and university research institutes; pre-departure orientation seminar for both work and study abroad to address student concerns, expectations, potential adjustment problems, and cultural issues; a re-entry workshop to help students synthesize their overseas experiences; a doctoral program in manufacturing and German, including dissertation research in a German university and work in an American company both in the United States and in Germany; and a number of certificates reflecting specialized study. (MSE)

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German for Engineers and Scientists: Initiatives in International Education

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At a recent workshop, sponsored by the National Science Foundation, participants agreed on the following goals for engineering education:

- Engineering graduates must be able to compete in the world marketplace;
- they must have strong intercultural communication skills;
- they must be able to work with professionals from other cultures and understand their needs;
- and they must be able to develop synergistic international relationships that can advance research as well as industrial productivity.

The future contributions and achievements of engineering graduates will be dependent upon how well they are prepared to participate in and deal with the multinational corporations of the 21st century. (Report on the NSF Workshop October 1992, p. 5)

Furthermore, the National Science Foundation panel stressed that the intercultural education of engineers is "the responsibility of the engineering profession as a whole through its professional societies, its accreditation body, the educational institutions, and the government." (p. 5)

How can the educational institutions address international issues and help students achieve a global perspective? In the past, several American universities trying to internationalize the curriculum encountered problems in reconciling course work required by the accreditation and courses that would add an international dimension. William Sangster, director of International Programs at the Georgia Institute of Technology, addressed the problem of an overloaded engineering curriculum in his paper "Engineering Education Faces the Challenge of Internationalization" (CIEE 1993). "Only recently has engineering education attempted to face up to the problems associated with the internationalization of the engineering practice." "The very stringency of engineering curricula provides the first stumbling block in the process. Insufficient flexibility is contained in most undergraduate engineering curricula to allow for language and culture studies."

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Preparing our students to be globally competent will require a wide range of academic courses, experiential programs as well as cultural activities. Nationwide, in the standard engineering or science curriculum, however, not many students gain proficiency in a foreign language because language courses are seen as adding even more time to the completion of the degree requirements. Furthermore, cooperative and academic exchange programs are not playing a significant role in the overall education of students in the sciences and engineering who are the most underrepresented discipline in international education.

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In order to help students meet the challenge of a global economy and to prepare them for careers with multinational corporations, Michigan Technological University (MTU) strives to provide a holistic education through a number of integrated interdisciplinary programs. However, since the majority of MTU students is in engineering and the sciences, we had to develop programs that would take into consideration the limitations imposed by the degree requirements that Sangster has pointed out. Nevertheless, we also wanted to prepare students to assume future leadership positions in the international realm which require skills to anticipate, manage, and adapt to rapid changes in the global technological scene.

Through thorough comparison of a number of programs, particularly academic exchanges and work programs, we tried to find the most beneficial international dimension for our students that would allow them to integrate language and international studies into the framework of their degrees.

German Area Studies at Michigan Technological University

German has the highest enrollment among modern languages at MTU, offers the greatest diversity in courses, and has successfully engaged in study-abroad and internship experiences for 12 years and provided international exposure to over 100 students. The major components of the intercultural education of science and engineering students in the German program at MTU are:

- Scientific German (one-year sequence)
- Study abroad for graduate students
- Internships in German industry and university research institutes
- Pre-departure orientation for work or study abroad
- Re-entry workshop
- Ph.D. program in manufacturing and German
- Short-term study abroad (DAAD, Goethe-Institut, CIEE, Fulbright etc.)

Scientific German

Students enrolled in Scientific German have studied German for a minimum of two years and have a grasp of basic grammar and vocabulary. The stress is, therefore, on specialized vocabulary, on reading skills, on the use of dictionaries, and on the more difficult structures of German. It is the goal of the course to familiarize students with the technical and scientific literature in their fields, to give them the tools necessary to comprehend scientific German, and to translate texts into coherent English.

In the latter part of the course, with more involved translation exercises, we are often confronted with problems: no German language teacher can be expected to have the necessary background in science and engineering (see also Rockwood and Grandin who address the problems of content, teacher competence, and use of materials). My students understand that my main function is to teach German and not the specialized terminology in the various fields of science and engineering. As a matter of fact, we appoint "experts" from the disciplines represented to help with the vocabulary and assure an accurate translation. We also use German exchange students on campus as resources and use a great deal of e-mail to solve problematic areas.

For their final project of the course, students translate an article from their field of study which they choose in conjunction with their advisor. All participating professors offered advice to the students and gave input to the German instructor for the evaluation of the translation. This cooperation between professors from science and engineering and German has a number of positive side effects: almost all professors benefit from this involvement because it gives them access to German literature. Furthermore, the professors found out through this project that their students were quite proficient in German. For some students, this edge opened the door to graduate studies here or abroad, increased research activities or an internship.

Study abroad for graduate students

MTU has active exchange programs with the University of Stuttgart, the Technical University of Hannover, the Technical University of Chemnitz, and the Swiss Federal Institute of Technology (ETH) in Zürich. So far, 23 students with advanced knowledge of German have participated in this exchange. Though the educational opportunities in these programs are excellent, the number of engineering and science students with advanced knowledge of German has been relatively small. Therefore, we had to look for programs that would increase the number of participants.

Study Abroad vs. Internships
(Note: see also William Nolting: "Work Abroad and International Careers'" in:NAFSA'S Guide to Education Abroad, Hoffa, Pearson, Slind eds., Washington, D.C.,1993, pp. 193-251)

Study	Work
time - often a whole year	ca. 3 months
cost of study - high	earn enough to cover living expenses
level of language proficiency - high	2 years enough to learn on the job
language - academic	everyday, more social interaction
social environment - university	more differences in work setting
different learning styles	practical experience
often with other American students	cultural immersion, independent
mainly junior year	at least junior, but also grad. students
Personal development:	
more protection in arranged exchange programs	independence, more stress, more gain growth in self-confidence greatest value for most students

Short-term programs abroad represent an increasingly attractive option for students, especially those facing financial limitations and time constraints. The traditional semester and year-long programs may still be regarded as the ideal, but study abroad professionals recognize that the needs of a diversified and non-traditional student population must also be met. Short-term programs may be stepping stones for more in-depth international programs or they may offer the only opportunity students ever have to experience other cultures. (NAFSA annual conference program 1994, p. 23)

Work abroad benefits are similar or superior to study abroad with respect to cultural immersion, language learning, and personal and career development. Furthermore,

work abroad offers additional benefits including very low participant cost, non-traditional locations, and options for non-traditional participants such as students in engineering and business (NAFSA p.29)

For most of our students at Michigan Tech, internships are much more feasible than a study-abroad program. In engineering, for example, very few study-abroad opportunities exist in the core curriculum because of problems in matching courses required here with courses offered at overseas universities. (p. 196) Engineering internships, on the other hand, are easily available in the summer. Furthermore, students can participate in an internship without delaying their graduation.

Internships

The most important component of the international program at MTU is an internship in Germany; qualified students work for 3 months in companies or research institutes where they practice skills acquired in German and in their field of study. These paid internships offer students a unique opportunity to improve their communication skills and cultural awareness while also gaining international work experience which can give them the competitive edge in their career.

Some advantages of an internship in Germany are:

Students

- have the opportunity to live for three months in Germany where they can use German in a real-world setting, immersed totally in the society where the language is spoken.
- perform a meaningful job using their expertise in their fields.
- learn how organizations and companies work in Germany.
- share their experiences abroad with other students who participated in the program or want to participate. This discussion among the students almost always intensifies the awareness of the actual learning experience that has taken place.
- mature rather fast during this work assignment abroad and are thus better equipped to define career goals.
- have better chances for placement because many employers value the international experience.

Pre-departure orientation

All students who participate in an internship or study abroad enroll in a pre-departure seminar. Since all students have had at least two years of German - and their linguistic "survival" can be assumed -, the course provides general orientation, technical as well as cultural information, and opportunities for simulation. Students are encouraged to

identify concerns, expectations, possible problems in the adjustment process, observe and describe differences in cultural behavior, and become aware of their own cultural identity. A great deal of time is spent on such issues as ethnocentrism, cultural relativity, different viewpoints and values, perception, stereotypes, culture shock, work ethics, nonverbal communication, adaptation strategies, etc.

The major part of the course deals with successful adjustment strategies. Students practice survival skills in a variety of simulations by taking roles that could be assigned to them in a real situation abroad. Participants also interview several German students as well as American students who had returned recently from an assignment abroad. Sensitizing students to the new environment before they were exposed to it proved to be of great value.

Students selected for study in Germany or Switzerland will also be familiarized with the differing educational system. An advisory committee guides them throughout their stay abroad and helps with course selection and transfer of credits.

Re-entry workshop

The re-entry workshop gives students a structured setting to synthesize their experiences abroad, to share them, to reflect on them, and to determine the extent of their personal and intellectual growth. Furthermore, assisting in the orientation of a new group of students almost always intensifies the awareness of the actual learning that has taken place. The course also helps students greatly to channel new interests, values, and skills into their everyday lives, thus guiding them to make better career choices.

The internship program in Germany began in 1986; so far 78 Michigan Tech students have added this invaluable experiential dimension to their education. This summer 9 students will have work assignments in Germany and gain international know-how. The combination of language and culture study with other fields, particularly engineering, has been quite important and successful for the women who make up about one third of all participants.

Ph.D. program in Manufacturing and German

MTU is very fortunate to have acquired Johnson Controls, Inc. as a partner in its international program. Since 1991, the company has supported the Ph.D. program in Manufacturing Engineering and German, primarily through fellowships. Students selected for the fellowships must be fluent in German and conduct part of their dissertation research in a German university. In addition to financial support for education, the company has also demonstrated its commitment to the training of the students by hiring all fellowship recipients for summer jobs in their plants throughout the United States. Johnson Controls has also sponsored students in internships in Germany.

All programs discussed have improved the professional qualification of the students and enhanced their career opportunities. However, we had to overcome a number of obstacles and revise the graduation requirements in order to attract students to the

programs. As mentioned before, most programs for study or work abroad require a minimum of two years of language study. To help overcome this "hindrance" in the crowded curriculum of students in engineering and the sciences, Michigan Tech offers many incentives for students to expand their world view:

MTU awards placement credit for up to two years of language study and encourages students to include advanced modern language and literature courses in the required Upper Division Thematic Studies (courses outside the major field). In addition to the traditional offerings in German language and literature, students can take such courses as Scientific German, German for Business, Philosophy of Science and Technology, Engineering Ethics, Intercultural Communication, and a pre-departure orientation for study or work abroad as well as a re-entry workshop.

To reward students for global achievements, MTU has established a number of certificate programs. The following certificates recognize completion of a specific sequence of courses with a focus on international studies:

Certificate in International Business	
Certificate in International Technology and Society	
Certificate in Modern Language and Area Study	(155 in German)
Advanced Certificate in Modern Language and Area Study	(31 in German)
Zertifikat Deutsch als Fremdsprache	193 awarded
(German proficiency adequate for work)	
Zentrale Mittelstufenprüfung	61 awarded
(German proficiency adequate for university studies)	

Most important is the fact that the general education requirements make it possible for students to become proficient in a modern language, take several area study courses, and gain experience abroad within the four-year program without reducing the quality of course work in their fields. Students can apply course credits earned in study-abroad programs and internships towards their degree and also integrate certificate programs focusing on international studies into the degree schedule.

Summary

If we examine the goals for engineering education stated in the beginning of this paper we can assume that Michigan Tech students with a degree in engineering or the sciences who participated in study or work in Germany have strong intercultural communication skills, have worked with professionals from other cultures and understand their needs, and have developed synergistic international relationships that can advance research as well as industrial productivity. With these qualifications, they should be able to compete in the world marketplace.

Living and working in an unfamiliar cultural environment demands heightened awareness of and attention to one's behavior and styles of communication and their effect on others. Many students who are immersed in a different culture develop special intercultural communication skills and adapt well to the new cultural environment, skills Margaret Pusch refers to the as the Chameleon Capability.

Some experts argue that understanding the distinctive structures of two or more different cultures is closely related to being creative. The individual with this advantage has learned to perceive reality from more than one perspective, and when faced with problems, intuitively seeks multiple solutions. For most students, an experience abroad, whether it is study or work, is a life-changing experience. In addition to language proficiency and cultural awareness, it brings a new outlook on political, historical, and economic issues. A stay abroad opens new perspectives, fosters friendships, and enhances career opportunities.